

BEFORE PROCEEDING WITH COMPLETE UNPACKING AND SETUP,
CONSULT UNPACKING AND INSPECTION INSTRUCTIONS ON PAGE 8

model LA 4
COMPRESSOR/LIMITER

EFFECTIVE WITH SERIAL # 9976A



United Recording Electronics Industries

8460 SAN FERNANDO ROAD, SUN VALLEY, CALIFORNIA 91352

(818) 767-1000

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1. Visual Inspection

Conditions: This inspection must be done before any tools or setup are applied to the product.

Test: Check to make sure the front panel and meter face are free from scratches, stains, discolorations, silkscreen errors, etc.. See that all appearance parts are properly aligned and free from defects in their appearance and functional behavior. Also check to see that there is no loose hardware and that all workmanship standards for soldering have been met.

Inspect all the power supply electrolytic capacitors and diodes along with all the product's i.c.'s to be installed with the correct polarity BEFORE turning the unit on. Also check the fuse value to be 250 volts, .25 amps, 3AG slow blow.

If any of the above requirements are not met send the unit to be reworked and notify the leadperson who delivered the products to the test department of the unit's failure.

2. Power Supply

CAUTION: DO NOT lean over the product when the power is first applied if the top cover is off the unit. Be ready to quickly turn off the power if a destructive condition should manifest itself.

Conditions: No input signal and no output load on the unit.
Set the line voltage with an autotransformer to 120 Vac.

Test: Place a d.c. voltmeter probe on the input to the power supply regulator VR1 and then switch on the power to the unit. Measure the voltage to be according to the following table along with all other specified measurements and tolerances.

Test Point	d.c. Voltage	Tolerance
input of VR1	+29.0	+ or - 1.5 Volt
input of VR2	-29.0	+ or - 1.5 Volt
output of VR1	+18.0	+ or - 0.7 Volt
output of VR2	-18.0	+ or - 0.7 Volt

Place a d.c. voltmeter probe on the input to the VR1 regulator and switch the line voltage switch, on the back of the unit, to the 230 position. Measure the voltage to be approximately +13.5 Vdc. Apply the probe to the input of VR2 and measure approx. -13.5 Vdc. Remember to set the line voltage switch back to the 115 position.

Vary the line voltage level with the autotransformer from 100 Vac to 140 Vac and measure the difference between these two voltage levels at the output of VR1 to be no more than 50 millivolts. Also, check to make sure that the red power LED is properly illuminated when the power is switched on.

Conditions: No input signal or load on the output.
Set the line voltage with an autotransformer to 120 Vac.

Test: Measure the input power of the unit at it's line cord to be less than 10 watts. If a power meter is not available then the average power can be determined by measuring the r.m.s. voltage and the r.m.s. current, and multiplying their product by the cosine of the phase angle between them.

4. Gain

Conditions: No load on the output.
OUTPUT LEVEL pot full clockwise.
THRESHOLD pot full counterclockwise.
INPUT RANGE switch (on back panel) in the LOW position.

Test: Apply a -20 dbu, 2 kHz input signal then measure the output level to be within +1 or -1 dbu of +20 dbu. Set the INPUT RANGE switch to the HIGH position and measure the output level to be within +1 or -1 dbu of 0 dbu.

Note: All of the following tests will have the INPUT RANGE switch in the HIGH position and the STEREO switch in the OFF position. Also, all non-limiting tests have the THRESHOLD pot full counterclockwise.

5. Common Mode Rejection

Conditions: No load on the output.
Make sure the reference signal does not clip.

Test: Apply a 0 dbu, 2 kHz input signal and set an output reference level with the OUTPUT pot. Connect the signal to both the + and - input terminals at the same time then measure the output level at 60 Hz and 20 kHz to be more than 40 db below the 2 kHz reference level that was set before tying the + and - together.

6. Input Impedence

Conditions: Use an a.c. voltmeter with an input impedence > 1 MOhm.
The shield and common wires on the input must not be shorted to each other or to any ground.

Note: This test requires two 10 kOhm, 1% resistors in series with the input of the LA4. One from the (+) output of the generator to the (+) input terminal of the LA4, and another in series from the (-) terminal of the generator to the (COM) input terminal of the LA4.

Test: With the LA4 disconnected from the series resistors, place the a.c. voltmeter on the output of the 10 kOhm source resistors and set the generator for a reference level of 0 dbu at 2 kHz. Connect the input of the LA4 to the output side of the source resistors and see that the level drops 3.25 db with + or - .25 db tolerance.

Conditions: Square wave generator is needed for this test.
No load on the output.
Make sure the reference signals do not clip.

Test: Place an a.c. voltmeter directly across the + and - output terminals of the limiter and set a reference level of +20 dbu at 2 kHz using a sine wave. Connect a 600 Ohm resistor and see that the level drops .55 db with + or - .1 db tolerance.

Set the sine wave generator for an output reference level from the limiter to have a +10 dbu output at 2 kHz with no load. Connect a 150 Ohm resistor and see that the level drops 2 db with + or - .1 db tolerance.

Apply a 2 kHz square wave to the input of the limiter and check the output waveform on an oscilloscope to have no ringing on either the positive or negative tops after the leading and trailing edges. This should be done using no load and a 600 Ohm load on the output.

Note: The load resistors should have at least a .5 watt rating with a 1% tolerance on their values of resistance.

8. Frequency Response

Conditions: Make sure the reference signal does not clip.
600 Ohm load on the output.

Test: Apply a 2 kHz input signal and set an output reference level of 20 dbu. Sweep the signal generator from 20 Hz to 20 kHz and check to see that the output level changes no more than +.5 db and -1 db from the reference level.

Increase the frequency of the input signal until the output level drops to 3 db below the reference level then measure this frequency to be approximately 60 kHz with + or - 10% tolerance.

Note: It is important to know that the 4136 i.c.'s used in the LA4 have a low slew rate so the level used as a reference will have an effect on the upper corner frequency.

Be sure to monitor the input signal level so as to insure that the reference input level does not vary. Some generators need to settle, especially at low frequencies, before a measurement can be made.

9. Maximum Input and Output Levels

Conditions: 150 Ohm load on the output.

Test: Apply a 10 dbu, 2 kHz input sine wave signal then adjust the OUTPUT pot so that the signal just starts to clip. This level should be greater than 20 dbu.

Increase the input signal until the OVERLOAD indicator (red LED) lights then measure the input signal to be greater than +20 dbu (7.75 Vrms).

Conditions: 600 Ohm load on the output.
600 Ohm terminator on the input terminal.
OUTPUT pot full clockwise.

Test: Using a 30 Hz to 15.7 kHz bandpass pass filter on the input of an a.c. voltmeter measure the output level of the limiter to be less than -74 dbu. Set the INPUT RANGE switch to the LOW position and measure the level to be less than -60 dbu.

Use an oscilloscope that is triggered on the line frequency and set for 5 mSec/div to measure the output of the voltmeter. Look for a continuous white noise level that has no more than 1 db jumps in level. There should be no burst (popcorn) noise and maybe only small level spikes (60 and/or 120 Hz) induced from the power transformer.

Use a hot moist breath for about 5 seconds on IC1 and the bottom of the p.c.b. under IC1 to see that there is no change in level.

Note: The hot breath can be produced by keeping your mouth wide open and gently forcing air from your throat. Also if a change in level does occur after the moist air is applied it is probably due to flux residues from the soldering process and should be cleaned with an isopropyl alcohol and distilled water solution with a 75% alcohol to 25% water mixture.

The bandpass filter that is specified in this test has slope rates for the high pass and low pass sections of 6 db/octave.

11. Meter Calibration

Conditions: 600 Ohm load on the output.
RATIO switch set to 8:1.
Set the METER switch to the GR position.

Test: Before power is applied to the unit make sure the mechanical zero adjustment on the face of the meter is set on the mark just below the -20 Vu on the meter then apply a 2 kHz, 0 dbu input signal and set an output reference level of 10 dbu with the OUTPUT pot. Set trimpot R51 (through the hole in the front panel) so that the meter on the LA4 reads exactly 0 Vu.

Adjust the THRESHOLD pot so that the output level drops 5 db from the output reference level then adjust R49 for a -5 Vu reading on the meter in the LA4. Reset the THRESHOLD pot full counterclockwise and set the output level with the OUTPUT pot for +8 dbu. Set the METER switch for +8 and see that the meter reading on the LA4 is at 0 Vu within + or - .5 db. Set the output level for +4 dbu, set the METER switch to +4 and, see that the meter reading on the LA4 is at 0 Vu within + or - .5 db.

Check to make sure that the lamps inside the meter of the LA4 have the proper illumination and that they are matched in brightness to each other. Also the needle in the meter should have smooth motion throughout it's range of operation.

Conditions: 600 Ohm load on the output.
RATIO switch set to 8:1.
Set the METER switch to the GR position.

Test: Apply a 2 kHz, 0 dbu input signal and set an output reference level of 0 dbu with the OUTPUT pot. Set the LA4 into 1 db of limiting using the THRESHOLD pot so that the output level drops 1 db from the reference. Reset an output reference with the OUTPUT LEVEL pot.

Increase the input signal 20 db and see that the output level will increase 2.5 db from the new output reference level. Adjust R34 for the 2.5 db increase if necessary.

Decrease the input level to 0 dbu and set the RATIO switch to the 20:1 position. Reset the LA4 into 1 db of limiting with the THRESHOLD pot and reset an output reference level. Increase the input level 20 db and observe the output level to increase 1 db within a 20% tolerance. Set the generator to 20 Hz and 20 kHz input signals and observe similar results to the 2 kHz setting.

Do the above test for each of the ratio settings of 12:1, 8:1, 4:1, and 2:1. The 2:1 ratio setting will need to be set for 3 db of limiting because of the soft knee in the threshold circuit for this ratio. A new output reference level must be made for each new ratio setting. The increase in output level should be 1.66, 2.5, 5, and 10 db for each of the 12:1, 8:1, 4:1, and 2:1 ratios settings respectively within a 20 % tolerance.

13. Attack and Release Times

Conditions: Tone Burst generator is needed.
RATIO switch set to 20:1.
Set the METER switch to the GR position.

Test: Apply a 2 kHz, 0 dbu, sine wave input signal and set an output reference level of 10 dbu with the OUTPUT LEVEL pot. Adjust the LA4 for 10 db of limiting with the THRESHOLD pot and set an output reference level with the OUTPUT LEVEL pot.

Apply a tone burst signal that has the same amplitude as the sine wave setup signal along with a gated output of a duration of 100 msec on and 3 seconds off and, that also has several cycles of a 20 kHz signal. With an oscilloscope measure the time duration from the peak amplitude on the leading edge of the gated signal to the smallest amplitude (which should be the same as the reference level) to be less than 10 msec.

Repeat the sine wave setup above with 10 db of limiting. With an oscilloscope measure the time duration for the signal level to increase to 63% of the final amplitude of the output signal after quickly switching the input signal down to -30 dbu to be no less than 100 msec and no greater than 1 second.

Note: For best resolution of the measurement use the full scale grid of the oscilloscope for the amplitude measurement.

Conditions: THRESHOLD pot full counterclockwise.
RATIO switch set for 8:1.
600 Ohm load on the output.

Test: For each input signal of 30 Hz, 200 Hz, 2 kHz, and 15 kHz at 10 dbu, set the output level 1 db below clip and measure the THD to be less than .25%.

Since the amount of limiting was not specified, and the THD is a function of the amount of limiting, then an amount of 5 db of limiting is what could be used for a typical real world measurement which should be less than 1.5% THD. Check the cathode of CR6 to have symmetrical peaks in the pulsating d.c. voltages from the rectifier.

Note: Make sure that the signal generator that is used has distortion less than .01% in order to insure an accurate measurement.

15. Stereo Threshold Trim

Conditions: THRESHOLD pot full counterclockwise.
STEREO switch set ON.
RATIO switch set for 12:1.
METER switch set for GR.

Note: It is important that the meter on the LA4 has been calibrated and tested before this test is done.

Test: Apply a 200 Hz input signal to the STEREO jack on the back panel that is exactly 800 mVolts in level. Adjust R57 so that the meter on the LA4 drops exactly 1 db from the 0 Vu position. The circuit drifts a little so wait for about 60 seconds before measuring the level.

Note: R57 slightly interacts with the ratio trim adjustment, R34, so if R57 is adjusted more than 1/8 of an inch in rotation then it will be necessary to recalibrate the ratio trim according to the ratio test above. Recalibrate R57 again after R34 has been readjusted. Also, the meter will have to be recalibrated after all adjustments have been made.

16. Threshold of Limiting

Conditions: THRESHOLD pot full clockwise.
INPUT RANGE switch in the High position.
RATIO switch set for 20:1.
METER switch set for GR.

Note: It is important that the meter on the LA4 has been calibrated and tested before this test is done.

Test: Apply a -20 dbu, 2 kHz input signal and see that the meter on the LA4 is showing limiting. Decrease the input signal to the point where the meter is showing only -1 db Vu reading and measure the input signal at this point to be -25 dbu, with + or - 2 db tolerance. Change the frequency of the input signal to 20 Hz and 20 kHz and see that this threshold remains at the same level. Repeat this test for the 12:1, 8:1, and 4:1 ratio settings.

Set the RATIO switch to the 2:1 position and decrease the input signal until there is only 1 db of limiting. The input signal level at this point should be -41 db according to the specification sheet however, the level typically ranges up to as much as -32 db.

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SECTION I
INTRODUCTION

1.1 FRONT PANEL

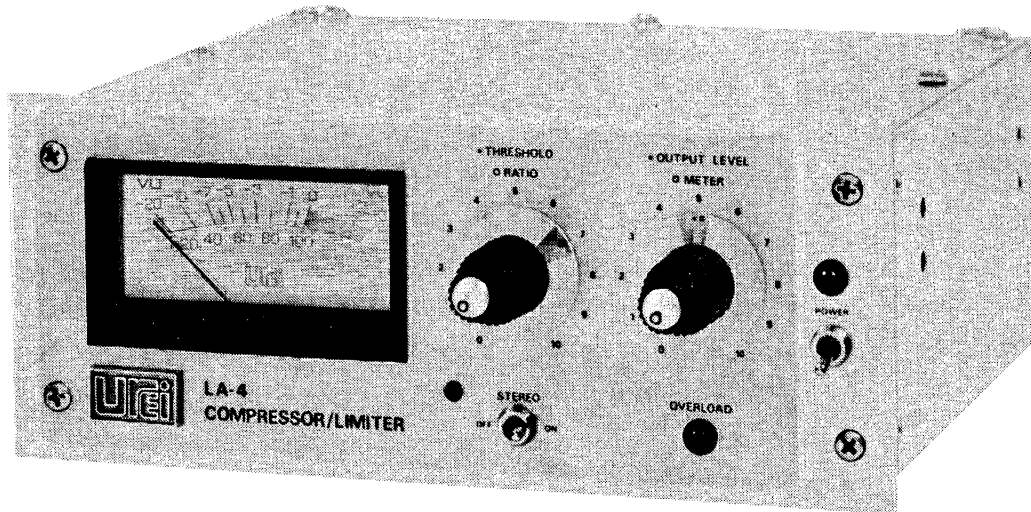


FIGURE 1. LA-4 FRONT PANEL

- A. **METER.** The LA-4's meter is factory set for OVU = +4 dBm (1.23 volts), or +8 dBm (1.96 volts) output level. In GR mode, the meter should read 0 dB so long as no gain reduction occurs. If the meter rests at some other value, it may be calibrated by inserting a small, slotted screwdriver through the hole just to the right of the meter.
- B. **STEREO COUPLER.** This switch should normally be OFF. When two LA-4's are interconnected (by means of a simple, rear panel connection), switching both STEREO switches ON will strap the gain reduction circuitry in both units to maintain a stable stereo image.
- C. **POWER.** This switch turns the LA-4's AC power ON and OFF. No signal flows when power is OFF.
- D. **METER FUNCTION.** The outer knob switches the meter function. In GR mode, the meter rests at 0 VU until gain reduction occurs; then it deflects down-scale corresponding to the number of dB of compression. In +4 mode or +8 mode, the meter indicates output level, where 0 VU respectively equals +4 dBm or +8 dBm output level.
- E. **OUTPUT LEVEL.** The inner control adjusts the gain of the LA-4's output stage. This control is independent of the THRESHOLD and RATIO settings.

F. COMPRESSION RATIO. The outer knob switches the amount of compression to 2, 4, 8, 12 or 20:1. The LA-4 can be considered to be limiting at compression settings of 8:1 or greater.

G. THRESHOLD. The inner control adjusts the level above which compression or limiting occurs. In conjunction with the rear panel Input Range switch, threshold may be set for a wide range of input signal levels and/or amounts of compression.

H. INPUT OVERLOAD INDICATOR. This LED (Light Emitting Diode) illuminates when the input level reaches +20 dBm (7.75 volts), high enough to cause distortion in the input amplifier. Avoid distortion by setting the output level of the source or by using an attenuation pad so the LED does not turn on. If a nominal +4 dBm source causes the LED to be constantly ON, be sure the rear-panel INPUT RANGE switch is in the HIGH position.

1.2 REAR PANEL

A. FUSE. For 110-125 V operation, use MDL 1/4-amp (slo-blo) fuse. For 220-250 V operation, use MDL 1/8-amp (slo-blo) fuse.

B. POWER. For safety, the IEC style receptacle ties the mains ground (third prong on the plug) to the chassis ground. In some instances it may be desirable to temporarily break the mains ground, using a 3-prong to 2-prong AC adapter, so that hum-causing ground loops can be detected. (See Section 2.6.)

C. MAINS VOLTAGE SELECTOR. This recessed switch can be set with a screwdriver for nominal 115 V or 230 V operation; be sure it is in the correct mode before connecting the LA-4 to the mains. If the unit is switched from one operating voltage to another, be certain to exchange the fuse for another of the correct rating.

D. INPUT TERMINALS. For balanced or floating sources, connect the high side of the line to the "+" terminal, the low side of the line to the "COM" terminal, and the shield to the "CHASSIS" terminal. For unbalanced sources, connect the high side of line to the "+" terminal, and the low side to the "COM" and "CHASSIS" terminals.

E. STEREO TERMINAL. For stereo operation of two LA-4's, connect a short cable with standard phono plugs between the two connectors on the rear chassis of the two units. Older model LA-4's (Black front-panel) do not have this connector. Instead, they have two terminals on the barrier strip.

Connect the center conductor of the single-conductor shielded cable to the terminal labeled "STEREO" and the shield to the terminal labeled "CHASSIS".

On the front panel, the switches labeled STEREO must be switched ON to link the gain reduction circuits together. Switching either switch to the OFF position disconnects the link between the limiters for independent operation. The stereo connecting cable may remain connected as long as one or both of the STEREO switches is in the OFF position.

F. OUTPUT TERMINALS. Connect the high side of a balanced or unbalanced line to the "+" terminal. Connect the low side of a balanced line or the shield of an unbalanced line to the "COM" terminal. If hum develops with an unbalanced line, connect a jumper between the "COM" and "CHASSIS" terminals. If a high impedance device is connected to the LA-4 output, connect a 620 ohm, 1/2 watt load resistor across the "+" and "COM" terminals.

G. INPUT RANGE SWITCH. This switch sets the LA-4's input sensitivity. "HIGH" position corresponds to a nominal input sensitivity of 0 dBm, for most professional lines. "LOW" position corresponds to a nominal input sensitivity of -20 dBm, for preamplified instruments, very "hot" condenser microphones, or semi-professional or hi-fi type equipment.

1.3 DESCRIPTION.

The UREI LA-4 Compressor/Limiter is a single-channel unit, although two may be strapped for stereo operation. Making use of UREI's patented Electro-Optical Attenuator technology, the LA-4 offers smooth, predictable performance coupled with ease of operation. The gain reduction is accomplished with an RMS detector, which is the analog of human hearing, so gain reduction is smooth and natural sounding. The detector consists of a light dependent resistor (LDR) and an electroluminescent light source which is a semiconductor, so it does not change or deteriorate with age.

Compression ratio is adjustable by an easily re-settable, multi-position switch that allows effects from a smooth 2:1 compression through a super tight-sounding 20:1 limiting. The calibrated ratio switch assures consistent and repeatable results.

Threshold is adjustable over a wide range, giving the flexibility to limit only the highest amplitudes, or to compress virtually the entire program.

A balanced, differential input stage and a transformer-isolated output assure trouble-free patching by avoiding ground loop problems. The input sensitivity is switchable to accommodate high level lines (nominal 0 dBm sensitivity) or lower level sources (nominal -20 dBm sensitivity). Input level is monitored by a bright LED indicator that illuminates whenever the incoming signal level is high enough to cause distortion in the first amplifier stage.

Output level is continuously variable. The large, illuminated VU meter can be switched to indicate dB of gain reduction, or output level; front panel switching sets the meter sensitivity for 0 VU = +4 dBm or 0 VU = +8 dBm output level, in accordance with the most widely used recording, sound reinforcement and broadcast standards. In gain reduction mode, the meter is driven by a completely isolated circuit, so distortion is minimized. All connections are made to a standard barrier strip.

The LA-4 is ideal for all phases of recording, re-recording, and sound reinforcement. It is also useful for broadcast production. However, due to its RMS-responding gain reduction circuitry, the LA-4 is not recommended for overmodulation protection of broadcast transmitters, disc or optical recorders, unless followed by a peak limiter such as the UREI 1176 LN.

1.4 DESIGNATION OF INPUT AND OUTPUT LEVELS

The term "dBm" has been commonly misapplied when describing voltage levels in high impedance lines. In fact, "dBm" refers to a power level, where 0 dBm is equal to 1 milliwatt, or 0.775 V across a 600 ohm termination. However, in high impedance circuits, power dissipation is negligible, and only the voltage level is of interest. The term "dBV" would be more useful here, where 0 dBV is equal to 1 volt (across any impedance).

Unfortunately, because 0 dBV (1 volt) across a 600 ohm line is equal to +2.2 dBm, the term "dBV" can be misleading. For this reason, the term "dBm" is used exclusively in this manual, with the understanding that, in other than 600 ohm circuits, the voltage level is the reference, not the power level.

For example, if an input sensitivity is rated at +4 dBm, and the input impedance is 40 kohms, the true sensitivity is 1.23 volts (1.23 volts across 600 ohms is +4 dBm). In strictly correct technical terms, the input would have a sensitivity of -14 dBm, which is the power dissipated by 1.23 volts across 40 kohms. However, a mixer of +4 dBm nominal output provides the correct voltage to drive the input, so the input sensitivity is rated at +4 dBm. In fact, if a 604 ohm terminating resistor is used, the input sensitivity becomes a true +4 dBm. The same criteria apply to output level ratings.

1.5 DEFINITION OF COMPRESSOR AND LIMITER

Compressor: A variable gain amplifier whose gain decreases as its input level increases past the threshold point. A compressor uses low compression ratios of approximately 2:1 or 4:1.

Limiter: A compressor with a high compression ratio of approximately 8:1 or greater. The high ratios maintain essentially constant output level despite increases in input level above the threshold.

Compression Ratio: The ratio, in dB, of input level change to output level change, above threshold. A compressor whose output level changes 1 dB for a 2 dB input level change, above threshold, has a 2:1 Compression Ratio. A compressor whose output level changes 1 dB for a 4 dB input level change above threshold has a 4:1 compression ratio, and so forth.

Threshold: The level at which compression begins. The UREI LA-4 Compressor/Limiter has an adjustable threshold. When the input level is below the set threshold, the unit functions as a 1:1 amplifier (a unity gain device). When the input level is above the set threshold, the unit functions as a compressor, or as a limiter, depending on the compression ratio selected.

1.6 SPECIFICATIONS

ELECTRICAL

INPUT:	Balanced bridging differential amplifier.
INPUT IMPEDANCE:	40 kohms, used as a balanced input. 20 kohms, used as an unbalanced (single-ended) input.
EQUIVALENT INPUT NOISE:	Less than -90 dBm (15.7 kHz bandwidth); input and output terminated with 600 ohm load.
MAXIMUM INPUT LEVEL:	Determined by rear panel switch to allow for optimum operation in different level environments; HIGH Range: Maximum +20 dB* LOW RANGE: Maximum 0 dB*
GAIN:	Adjustable with front panel gain control. Maximum 20 dB with input level switch in LOW position, or 40 dB with switch in HIGH position.
FREQUENCY RESPONSE:	±0.5 dB, 20 Hz - 20 kHz.
ATTACK TIME:	1 to 10 milliseconds for 63% correction, depending on signal waveform.
RELEASE TIME:	100 milliseconds to 1 second for 63% return, depending on duration of limiting.
COMPRESSION RATIO:	2:1, 4:1, 8:1, 12:1 or 20:1; switch selectable from front panel.

* Ref. 0 dB = 0.775 V rms.

THRESHOLD OF LIMITING: Adjustable with front panel threshold control and rear panel input level switch. Minimum level (± 2 dB) to achieve 1 dB limiting is:

RATIO	LOW RANGE	HIGH RANGE
2:1	-61 dB*	-41 dB*
4, 8, 12, 20:1	-45 dB*	-25 dB*

OUTPUT: Floating, transformer isolated.

OUTPUT LOAD: 150 ohms or greater.

POWER OUTPUT: +24 dBm into a 600 ohm load (12.8 V);
+20 dB* into a 150 ohm load.

POWER REQUIREMENTS: 100 to 125 VAC or 200 to 250 VAC,
50/60 Hz, switch selectable, less than 10 W.

ENVIRONMENT: Operating, $+0^{\circ}\text{C}$ to $+50^{\circ}\text{C}$.
Storage, -20°C to $+60^{\circ}\text{C}$.

PHYSICAL

CONNECTIONS: Input and output, through rear chassis barrier strip.
Stereo interconnect through phono jack.
Power through 3-wire IEC style connector.

INDICATORS: Standard VU meter, switch selectable to read output level (0 VU reference +4 dBm or +8 dBm), or amount of gain reduction. LED indicator for input overload. LED power indicator.

DIMENSIONS: 216 mm W x 89 mm H rack panel, depth behind panel is 203 mm (8-1/2" W x 3-1/2" H x 8" D).

FINISH: Panel is 3.18 mm (1/8") brushed, clear anodized aluminum in two shades. Chassis is cadmium plated steel.

WEIGHT: 2.95 kg (6.5 pounds).

SHIPPING WEIGHT: 3.63 kg (8 pounds).

ACCESSORIES: Single Rack Mount Kit, No. SR-1.
Double Rack Mount Kit, No. DR-1.
Model 301 XLR/QG Adapter kit for input and output.

SECTION II
INSTALLATION

2.1 UNPACKING AND INSPECTION

Carefully examine the contents of the shipping carton for any signs of physical damage which could have occurred in transit. Though your LA-4 was carefully packed at the factory, and the container was designed to protect the unit from rough handling, accidents do happen.

IF DAMAGE IS EVIDENT, DO NOT DESTROY ANY OF THE PACKING MATERIAL OR THE CARTON. IMMEDIATELY NOTIFY THE CARRIER OF A POSSIBLE CLAIM FOR DAMAGE. SHIPPING DAMAGE CLAIMS MUST BE MADE BY YOU, THE CONSIGNEE.

The shipment should include a two-part warranty card bearing the same serial number as the LA-4, an instruction manual, and the LA-4. IN ORDER TO ACTIVATE THE ONE-YEAR LIMITED WARRANTY, THE CARD MUST BE COMPLETED AND THE RETURN PORTION MAILED IMMEDIATELY.

2.2 ENVIRONMENTAL CONSIDERATIONS

The LA-4 will operate satisfactorily over a wide range of ambient temperatures, from 10 to 50 °C (45 to 121 °F). If the unit is installed in an equipment rack that also contains heat-producing equipment (such as power amplifiers), adequate ventilation should be provided. This will prolong component life and maximize operational stability. Also, while circuitry susceptible to hum pickup is fully shielded, installation should nevertheless be planned to avoid locating the LA-4 immediately adjacent to large power transformers, motors, etc.

2.3 RACK MOUNTING A SINGLE UNIT

The SR-1 kit (optional) allows mounting of one LA-4 in a standard 19" USASI rack. The unit occupies two standard spaces (3-1/2" high). The SR-1 kit should contain the following items:

QUANTITY	DESCRIPTION
2	Rack Adapter Angles
2	Rack Extensions
4	#6-32 Oval Head Screws (black)
4	#6 Lock Washers
4	#6-32 Nuts
4	#8-32 Pan Head Screws
4	#8 Lock Washers

The SR-1 Installation Procedure is as follows:
(Refer to Figure 2)

1. Using the #6-32 screws, lockwashers, and nuts, mount the angles to the back side of the rack extensions. Do not tighten the screws at this time.
2. Using the #8-32 screws and lock washers, mount the angle and rack extension assemblies to the tapped holes in the sides of the LA-4. Do not tighten the screws at this time.
3. The LA-4 front panel is adjustable to allow optimum alignment of the front panel with the rack extensions. For precise alignment, loosen the front panel mounting screws, as well as the top and bottom cover screws (1/2 turn is adequate). Adjust the relative positions of the brackets and panels, and then tighten all hardware.

2.4 RACK MOUNTING TWO UNITS

The DR-1 kit (optional) allows mounting of two LA-4's side by side in a standard 19" USASI rack. The assembly occupies two standard spaces (3-1/2" high). The DR-1 kit should contain the following items:

QUANTITY	DESCRIPTION
2	Joining Plates
2	Rack Mounting Angles
2	Spacer Plates
4	#8-32 Pan Head Screws
4	#8 Lock Washers

The DR-1 Installation Procedure is as follows:
(Refer to Figure 3)

1. Place the two LA-4's side by side, with front panels touching. Remove four screws from the top of each unit, as illustrated, to permit positioning of the joining plate. Replace the screws through the plate and covers, but do not tighten completely at this time.
2. Turn the assembly upside down, and install the bottom joining plate in the same fashion as the top joining plate (step 1).
3. Using the #8-32 screws and lock washers, mount one angle and one spacer plate to each side of the LA-4 assembly. The spacer plates should be located between the angles and the LA-4 chassis. The mounting holes in the LA-4 are tapped, so nuts are not required. Do not tighten the screws at this time.

4. The LA-4 front panels are adjustable to allow optimum alignment of the front panels with the rack mounting angles. For precise alignment, loosen the front panel mounting screws, as well as the top and bottom cover screws (1/2 turn is adequate). Adjust the relative positions of the angles and panels, and then tighten all hardware.

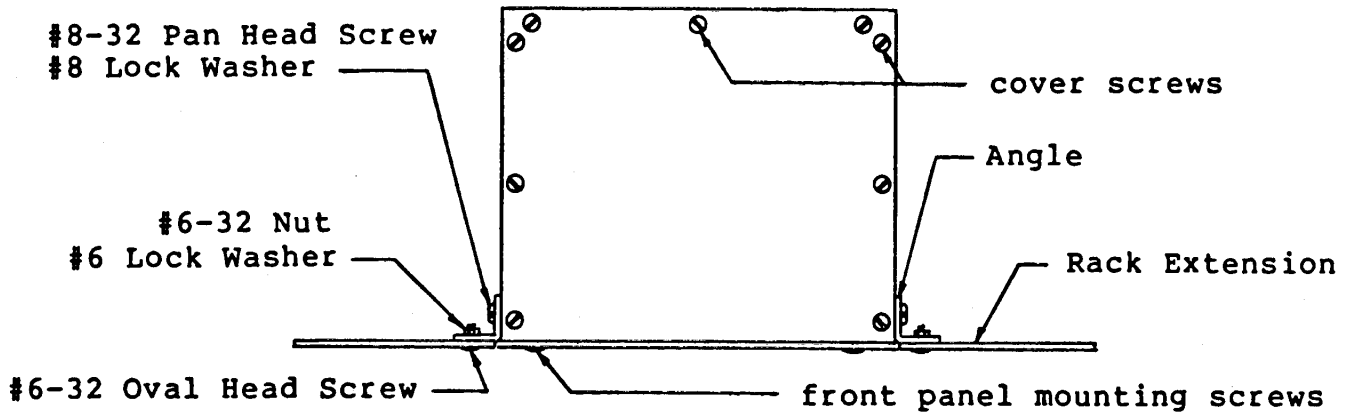


FIGURE 2. MOUNTING DETAILS FOR SR-1 RACK MOUNT KIT.

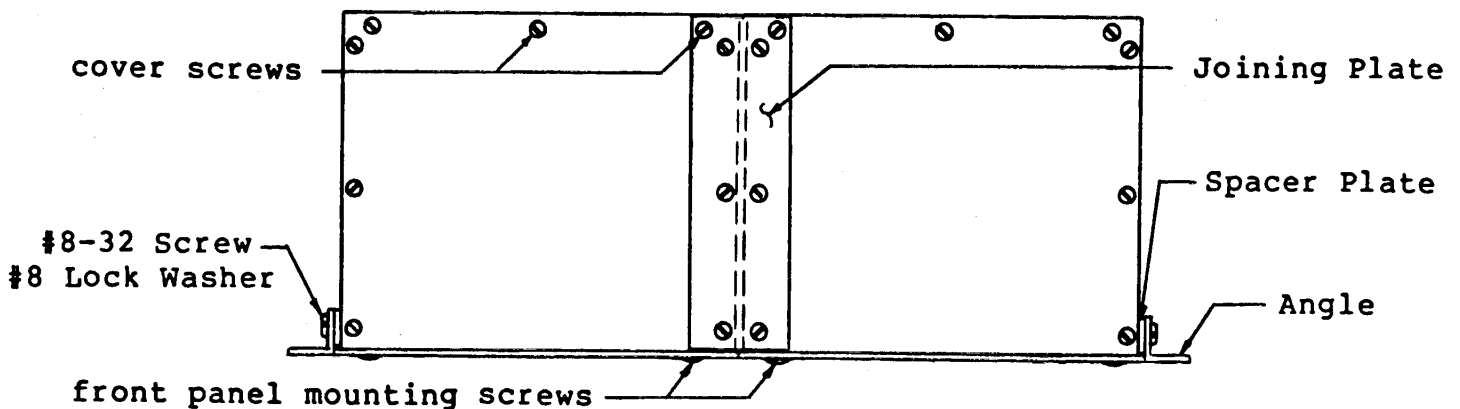


FIGURE 3. MOUNTING DETAILS FOR DR-1 RACK MOUNT KIT.

2.5 LINE VOLTAGE SWITCH

Unless a tag on the line cord specifies otherwise, the LA-4 was shipped ready for operation with nominal 115 VAC power mains. In order to change this for nominal 230 V (50 or 60 Hz), slide the VOLTAGE SELECTOR switch on the rear panel to the 230 position. The voltage is visible in a window next to the switch slot. Be sure to change the fuse to the correct value, 1/8-amp slo-blo when changing to 230 V operation or 1/4-amp slo-blo for 115 V operation. A small screwdriver should be used to move the recessed switch.

2.6 POWERING

The LA-4 may be operated from either 110 - 125 VAC or 220 - 240 VAC mains (50 or 60 Hz, single phase). As indicated in section 2.5, the nominal line voltage may be selected with a rear panel switch. BE SURE TO VERIFY BOTH THE ACTUAL LINE VOLTAGE, AND THE SETTING OF THE VOLTAGE SELECTOR SWITCH BEFORE CONNECTING THE LA-4 TO THE MAINS.

AC mains power is supplied to the Model LA-4 through an IEC-style 3-conductor receptacle mounted on the rear of the chassis, and a matching 3-wire power cable. The ground pin of the connector is tied to the chassis of the Model LA-4 in order to comply with electrical codes. In some installations this may create ground-loop problems. Ground loops can become very evident (as hum and buzz) if a significant potential difference exists between the AC conduit ground and the grounded metal enclosure in which the chassis is installed. If hum is experienced, check for the possibility of ground loops by using a 3-prong to 2-prong AC adapter, ungrounding the AC plug temporarily. This ungrounds the LA-4, and may cure the hum or buzz, but is not a substitute for proper system grounding. Be aware that unless the Model LA-4 Compressor/Limiter is AC grounded, a safety hazard can exist. UREI accepts no responsibility for legal actions or for direct, incidental or consequential damages that may result from violation of any electrical codes.

2.7 EXTERNAL CONNECTIONS

Input and output signal wires should be shielded cable, and connected in accordance with standard wiring practice, as indicated on the rear panel barrier strip. Section 1.2 contains wiring information, which is augmented by the diagrams in Figures 4 and 5.

When strapping two units together for stereo operation, use low capacitance shielded cable, and restrict the length to under ten feet.

If the LA-4 is connected to a high impedance circuit, we recommend shunting the "+" and "COM" output terminals with a 620 ohm, 1/2 watt resistor. This assures proper loading for the LA-4. (See section 2.8 regarding input termination).

In situations where Input and Output will be connected and disconnected frequently, we suggest the use of the Model 301 XLR/QG Adapter. This is a small box containing one male and one female XLR connector for Input and Output. It is completely wired and connects quickly to the rear panel barrier strip. It mounts over the barrier strip on the rear panel using two screws. The Model 301 is available through your UREI dealer.

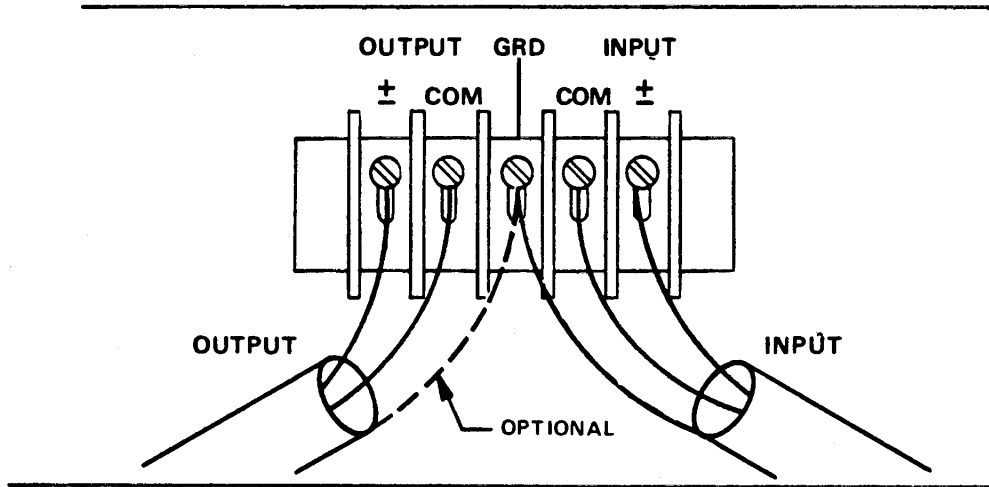


FIGURE 4. CONNECTING THE LA-4 WITH BALANCED INPUT AND BALANCED OUTPUT CIRCUITS.*

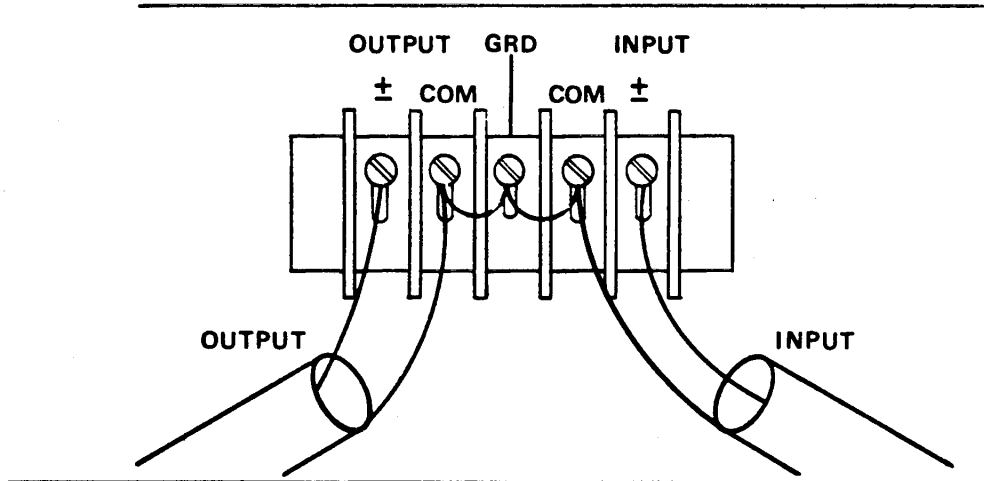


FIGURE 5. CONNECTING THE LA-4 WITH UNBALANCED INPUT AND UNBALANCED OUTPUT CIRCUITS.*

*With a balanced input and unbalanced output, or vice-versa, just use the appropriate connections suggested by each of the above diagrams.

2.8 IMPEDANCE AND TERMINATION

This section has been provided to better explain the nature of matching and bridging inputs, the use of terminating resistors, and the relationship between actual input impedance and nominal source impedance. Most electronic outputs work well when "terminated" by a load (connected to an input) having the same or a higher actual impedance. Outputs are usually overloaded when terminated by an impedance that is lower than the source impedance. When the input impedance is nearly the same impedance as the source, it is known as a "matching" input. When an input is 10 times the source impedance, or more, the input is considered to be a "bridging" input.

The UREI LA-4 has actual input impedances of 40 kohms (40,000 ohms) when used in a balanced configuration, and 20 kohms when used in an unbalanced configuration (they are high impedance inputs). This makes the LA-4's inputs suitable for use with virtually any nominal source impedance, low or high. The LA-4's inputs will bridge 150 ohm or 600 ohm (low impedance) sources and will match 10 kohm or greater impedance (high impedance) sources. In most cases, it is not necessary to place a 600 ohm "terminating resistor" across the input of the LA-4. In fact, most 600 ohm sources operate normally when bridged by a high impedance, acting as though no load were connected to the source device.

A 604 ohm termination resistor is required at the LA-4's output only if it is connected to a high impedance line. The only instance where an input termination resistor may be required is when the manufacturer of the source device specifically states that a terminating resistor is necessary. In such cases, there is usually a special type of output transformer in the source device, or the source device is made of precision, passive components (no transistors or tubes). An example of a unit requiring a terminating resistor is a passive equalizer. The terminating resistor assures optimum frequency response in that device. If a 150 ohm or 600 ohm resistor is specified for the source device, it should be installed at the end of the cable nearest the LA-4 in order to minimize possible hum, noise or signal losses in the cable.*

* 600 ohms is not a standard resistor value. A 604 ohm precision resistor may be used, but 620 ohm or 680 ohm resistors are close enough in value to 600 ohms and are more widely available.

2.9 INPUT AND OUTPUT LEVELS AND OVERLOAD

The LA-4's differential input amplifiers are capable of being driven by signals up to a level of +20 dBm (input range switch in HIGH mode), or 0 dBm (input range switch in LOW mode), above which clipping, distortion and/or slew-rate limiting occurs. The input overload LED turns on when peak signals exceed the clipping level, and will remain on long enough to be seen even if the excess signal is only a brief transient. To avoid distortion when the LED indicator flashes more than occasionally, either lower the output level of the source feeding the LA-4, or use an external attenuation pad. If the LED is illuminated virtually continuously, check the input range switch; if it is in LOW mode and the input source is +4 dBm nominal level, move the switch to HIGH mode.

The output amplifier is capable of delivering +24 dBm into a 600 ohm load (12.3 volts) or +20 dB into a 150 ohm load (7.75 volts, which is actually +26 dBm referenced to 1 milliwatt). Average output levels can be monitored with the LA-4's VU meter, but remember that transient peaks may exceed the meter indication by as much as 20 dB. The actual output headroom depends on the program material, the threshold, and the compression ratio selected.

SECTION III

OPERATING INSTRUCTIONS

3.1 GENERAL

The LA-4 Compressor/Limiter is designed to prevent an increase in output level beyond a pre-determined point (the threshold), and due to its unique design, the unit functions as a compressor or a limiter. The effect is illustrated in Figure 6. The point at which the compressed curves break away from the straight "No Gain Reduction" line is determined by the setting of the "Threshold" control. Incidentally, this point is sometimes known as the "rotation point" or "threshold point." It can be seen from the curves that at low or moderate settings of the "Ratio" control (2:1 or 4:1), the output level increases very gradually as the input level rises above the threshold point. The 2:1 setting automatically lowers the threshold for a gentle, overall dynamic range compression. It can also be seen that at higher settings of the "Ratio" control (8:1 through 20:1), there is virtually no increase in output level as the input level rises above the threshold point.

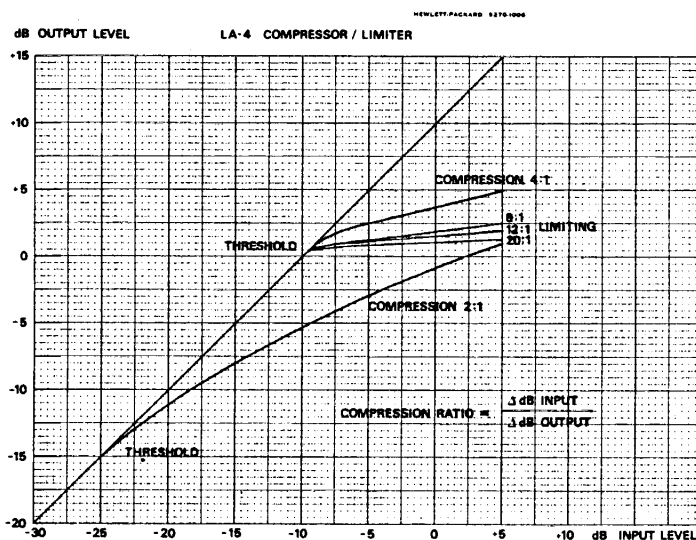


FIGURE 6. TYPICAL INPUT VERSUS OUTPUT LEVEL CURVES FOR LA-4 AT VARIOUS COMPRESSION RATIOS.

3.2 CONTROL SETTINGS

1. The rear-panel "Input Range" switch should be pre-set at the appropriate position: "High" for nominal +4 dBm sources, or "Low" for nominal -20 dBm sources.

2. The "Stereo" switch should be in the "Off" position; even if stereo operation is desired, initial setup is done independently for each LA-4.

3. Turn the "Power" switch "On," and wait a few seconds to assure the system is warmed up and operating with complete stability. Set the "Meter" switch to either "+4" or "+8", whichever level corresponds to the nominal operating level of your audio system. Feed typical program material to the LA-4 input, and observe the "Input Overload" indicator to ensure it does not illuminate more than occasionally. If the indicator is frequently or continuously illuminated, lower the incoming signal level (with the output attenuator of the source device or with an attenuation pad), and check the position of the INPUT switch on the rear panel.

4. Set the "Ratio" control to the desired amount of compression. The optimum setting varies with program material, and some experimentation may be useful (you may reset the "Ratio" after setting the "Threshold"). With a typical input signal present, adjust the LA-4's "Output Level" control for average meter deflections of 0 VU. Peaks may occasionally deflect the pointer off scale.

5. Set the "Threshold" control at "0" (full counterclockwise), so that the threshold is above any input signal. Set the "Meter" switch to "GR" mode, and observe the meter. Gradually rotate the "Threshold" control in a clockwise direction, lowering the threshold point until the meter displays 3 dB to 5 dB of gain reduction (average), with occasional peaks of 10 dB to 20 dB downward deflection. As with the "Ratio," setting, some experimentation may be useful in determining the optimum "Threshold" setting.

3.3 STEREO OPERATION

If two LA-4 Compressor/Limiters are to be used in tandem for stereo programs, the gain reduction of each unit can be made equal, regardless of which channel is instigating the action. The channel that requires the most gain reduction will drive the other channel to the same degree of gain reduction, thereby maintaining a stable stereo image. For stereo operation, repeat the procedure in Section 3.2 separately for each unit, and then turn both the "Stereo" switches "On". In "Stereo" mode, the meters in each unit will independently display the output level ("Meter" switch in "+4" or "+8" position), but will both display the same amount of gain reduction ("Meter switch in "GR" position). The tracking in "GR" mode is due to the fact that the level detection circuits in both units are strapped.

3.4 VU METER

The VU meter serves two functions: it indicates output level as well as gain reduction directly in dB. When the "Meter" switch is placed in the "+4" or "+8" position, the meter indicates the output level. 0 VU or 100% corresponds to a voltage output of +4 dBm or +8 dBm, depending on the switch setting.

The position marked "GR" permits the meter to indicate the amount of gain reduction or peak limiting directly in dB. During periods of no gain reduction, the pointer will return to 0 VU on the meter scale. The pointer is initially set to this position by means of the screwdriver adjusted control accessible through a hole in the LA-4 front panel.

SECTION IV

MAINTENANCE

4.1 GENERAL

The LA-4 is an all solid-state unit, ruggedly constructed with only the highest quality components. As such, the LA-4 should provide years of trouble free use with normal care. All parts used are conservatively rated for their application, and workmanship meets the rigid standards you have learned to expect in UREI products.

NO SPECIAL PREVENTIVE MAINTENANCE IS REQUIRED.

4.2 GAIN REDUCTION METER ZERO ADJUSTMENT

When switched to "GR" mode, and with no signal applied to the LA-4 input, the meter pointer should rest at 0 VU. If the pointer rests at some other position, allow about 1/2 hour for the LA-4 to warm up. Then insert a small slotted screwdriver in the hole on the LA-4 front panel just to the right of the meter, engaging the trimmer located 1-1/4" behind the front panel. Turn the screwdriver until the pointer indicates 0 VU. This completes the adjustment.

4.3 G.R. METER CALIBRATION

Before proceeding with stereo tracking adjustment, the G.R. meter accuracy should be checked by following this procedure.

1. Apply a 1000 Hz signal to the Input at a level between 0.1 and 1 volts.
2. Switch the meter to +4, and adjust the output to read 0 VU.
3. Advance the threshold control to drop the output 5 dB (meter reads -5 VU).
4. Switch the meter to G.R.: it should read -4.5 to -5.5 VU. If so, proceed to the stereo tracking calibration (Section 4.4). If not, adjust R 49 (tracking pot) to read -5 VU. Return to step 2 above and recheck.

4.4 STEREO TRACKING

1. Calibrate the meters as described in Sections 4.2 and 4.3.
2. Set the front panel controls as follows:

Thresholds:	Counterclockwise
Ratio:	8
Meters:	G.R.
Stereo Switches:	"ON"
Outputs:	Counterclockwise

3. Apply a 1000 Hz signal to the input at a level between 0.1 and 1 volts. Advance threshold on the left hand unit until the meter reads -5 VU. Check the meter on the right hand unit. If it is not at -5, adjust R 57 (Internal threshold trim on right hand unit) for -5 VU reading.
4. Switch the Ratios on both units to 20 (20:1). Reset the front panel threshold control on the left hand unit to read -5 VU. Retrim R 57 on the right hand unit to read -5 VU.

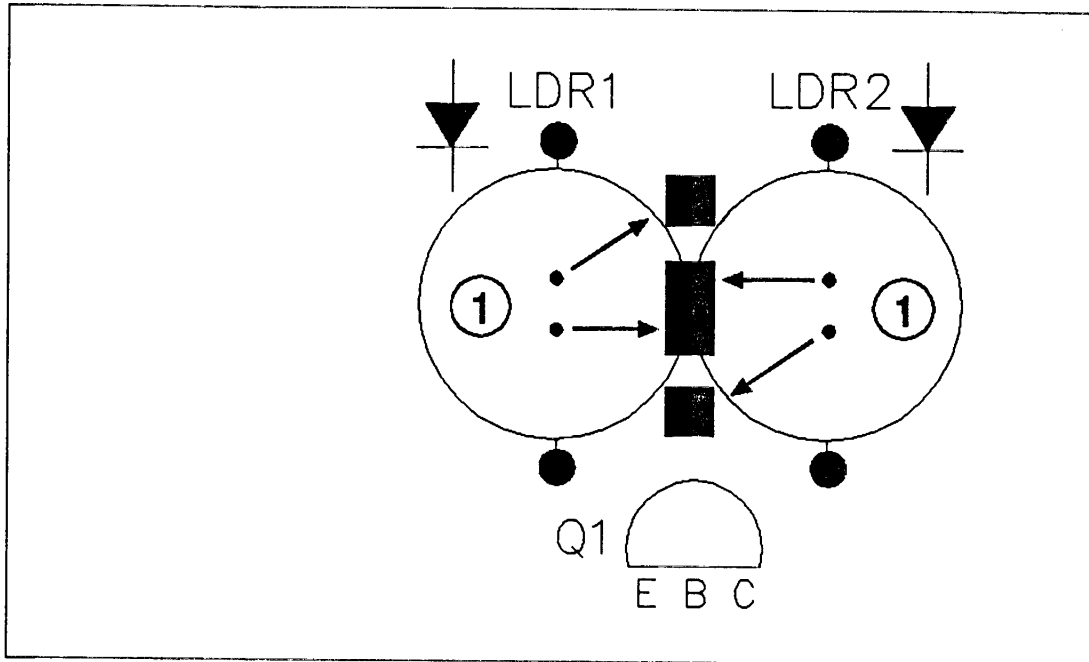
NOTE: In some cases, particularly where two units have widely different serial numbers, good tracking may be difficult to achieve on the 20:1 ratio. If you are tracking a very early LA-4 (with a black front-panel), check that resistor R 28 is 33 K ohm; change it if it is not.

4.5 REPAIRS AND WARRANTY

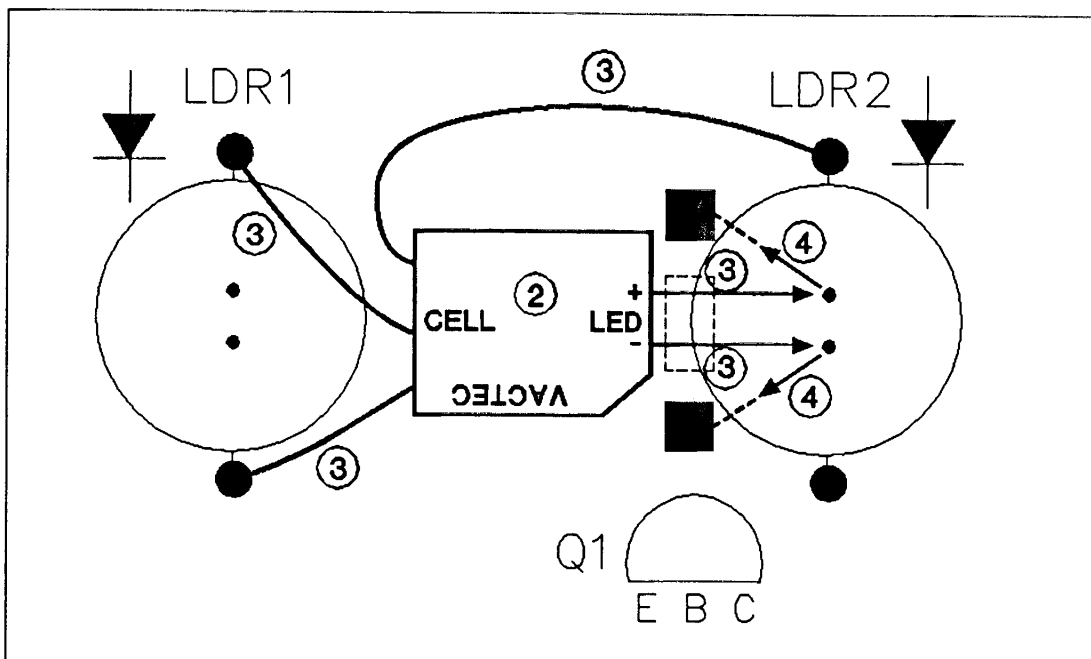
This product is factory warranted to the original purchaser against defects in material and workmanship for one year after initial purchase. This limited warranty must be activated at the time of purchase by returning the registry portion of the Warranty Card to the factory. Should a malfunction ever occur, the dealer from whom the unit was purchased will be glad to handle return for factory repair. Please call or write to the factory for a Return Authorization Number which must accompany all repairs. For prompt service, ship the unit prepaid directly to the factor with the R.A. Number visible on the shipping label. Be sure it is well packed in a sturdy carton, with shock-absorbing material such as foam rubber, styrofoam pellets, or "bubble pack" completely filling the remaining space. Particular attention should be paid to protecting the controls, switches, etc. Tape a note to the top of the unit describing the malfunction, and with instructions for return. We will pay one-way return shipping costs on any in-warranty repair.

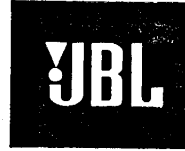
Because of specially selected components in this product, field repairs are not authorized during the warranty period, and attempts to perform repairs may invalidate the warranty.

LA-4 OPTOCOUPER RELACEMENT



- ① REMOVE OLD LDR1 and LDR2 OPTOCOUPPLERS.
- ② INSTALL OPTOCOUPER. (P/N HM13-0499-02 RED)
- ③ CONNECT OPTOCOUPER TO LDR1 and LDR2 PINS AS SHOWN BELOW.
- ④ CONNECT LDR2 TO THE PADS AS SHOWN BELOW.





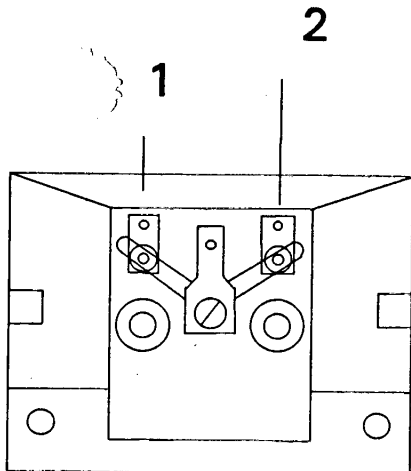
MODUTEC V.U. METER RETROFIT INSTRUCTIONS

MODUTEC METER PART NUMBER (40-0022) IS BEING REPLACED WITH MODUTEC METER (40-0026) , THE MOUNTING IS THE SAME, THE MOUNTING BEZEL P/N (257653) WILL REMAIN THE SAME .

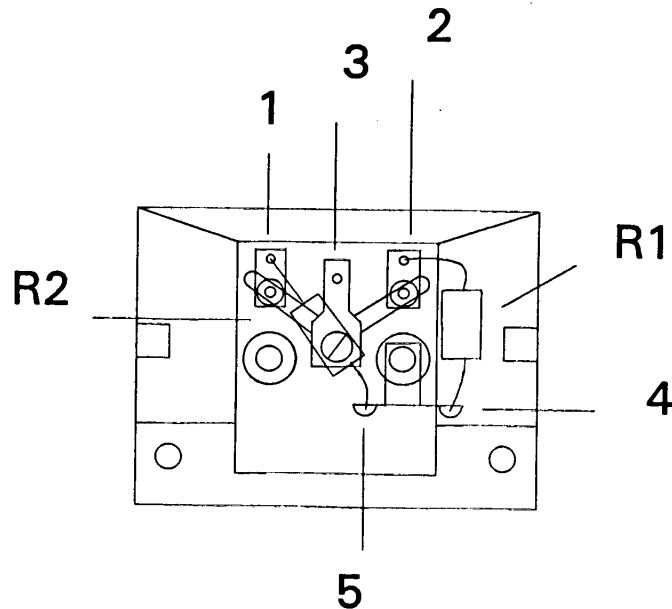
D. C. FOR THE LAMPS WILL BE CONNECTED TO CONNECTIONS ILLUSTRATED BELOW (DRAWING 1)WITH SERIES WIRING , (EXAMPLE EARLY 1176 REV, (A) THRU (G) CONNECTION 1 & 2 .

NOTE : FORMER LAMPS (EXAMPLE EARLY LA4) WIRED IN PARELLEL MUST USE 330 OHM 1 WATT RESISTORS (R1&R2) WIRED IN SERIES WITH EACH HOT LEAD , THE COMMON LEAD TO CONNECTION (3) .
A TERMINAL STRIP (2T) MUST BE ADDED TO THE METER HOUSING BY ATTACHING THE UNUSED METAL TAB ILLUSTRATED IN THE PICTORIAL DRAWING 2 , CONNECTION 4 & 5 ARE LAMP D.C. CONNECTION .

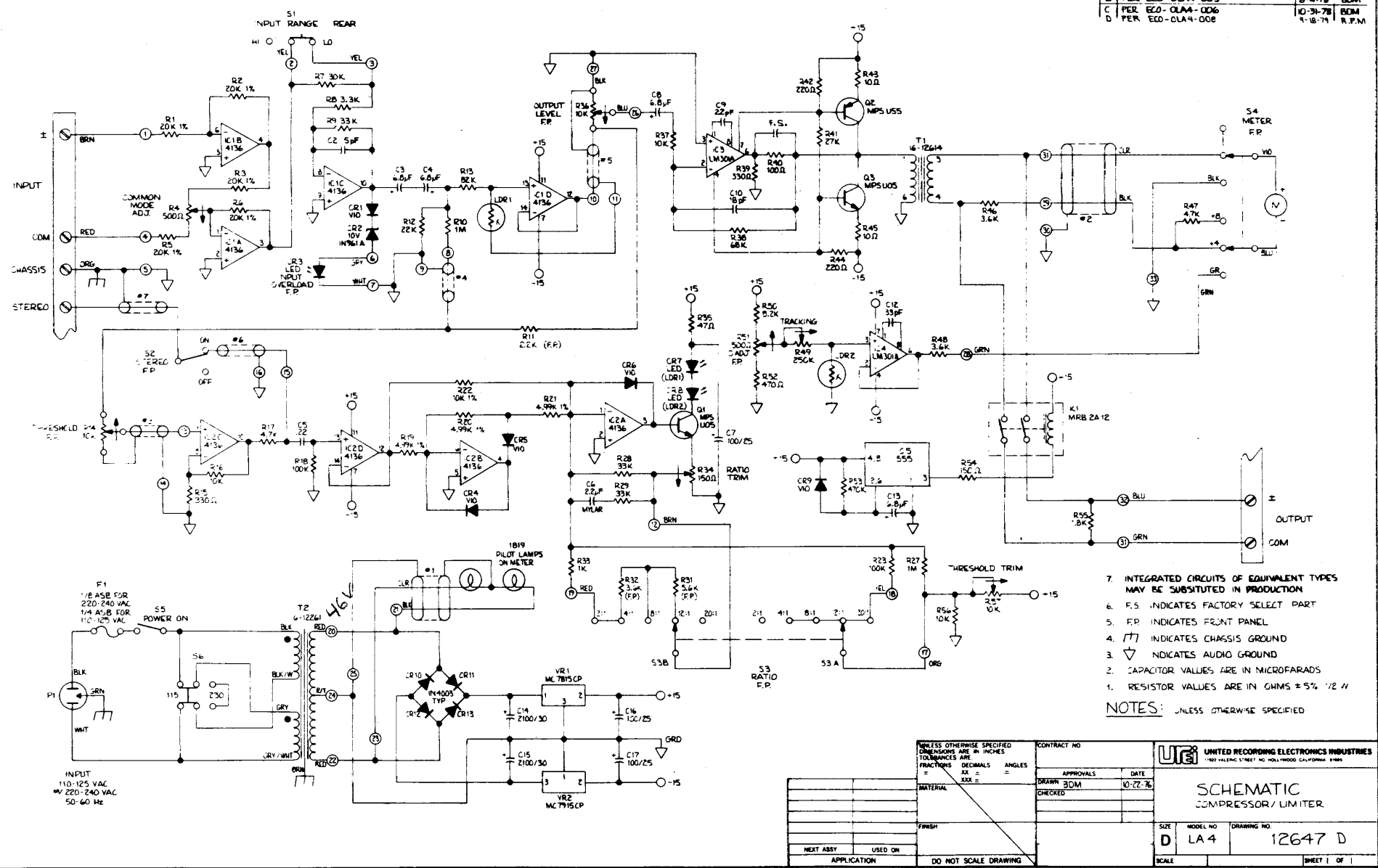
DRAWING 1



DRAWING 2



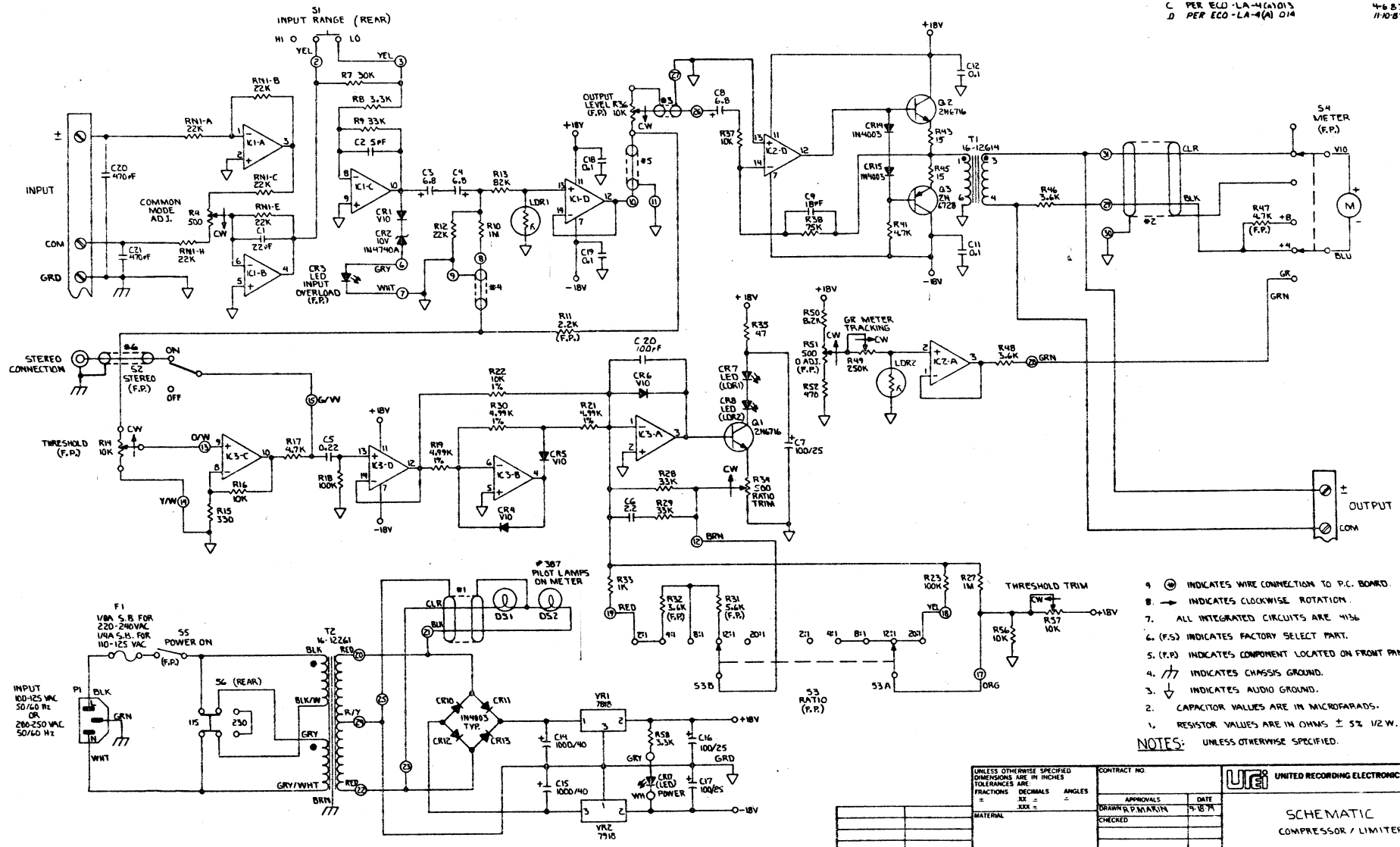
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A		CHANGE IC3 & IC4 FROM 846 DE TO LM301A	7-7-77	
B		PER ECO-OLA4-005	8-4-78	EDM
C		PER ECO-OLA4-006	10-31-78	EDM
D		PER ECO-OLA4-008	1-8-79	R.P.M.



7. INTEGRATED CIRCUITS OF EQUIVALENT TYPES MAY BE SUBSTITUTED IN PRODUCTION
 6. F.S. INDICATES FACTORY SELECT PART
 5. FP. INDICATES FRONT PANEL
 4. ▮ INDICATES CHASSIS GROUND
 3. ▽ INDICATES AUDIO GROUND
 2. CAPACITOR VALUES ARE IN MICROFARADS
 1. RESISTOR VALUES ARE IN OHMS ± 5% 1/2 W
- NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES		CONTRACT NO.	
DRAWN 3DM		DATE 10-27-78	
CHECKED			
MATERIAL			
FRESH			
NEXT ASSY USED ON			
APPLICATION		DO NOT SCALE DRAWING	
UNITED RECORDING ELECTRONICS INDUSTRIES 1780 HELLING STREET MC HOLLYWOOD CALIFORNIA 91608		APPROVALS	
S3		DATE	
D LA 4		DRAWING NO. 12647 D	
SCALE		SHEET 1 OF 1	

REVISIONS			
ZONE	LTN	DESCRIPTION	DATE APPROVED
A		PER ELD-LA-4(A)-009	8-29-80 R.P.M.
B		PER ELD-LA-4(A)D10	12-12-80 R.P.M.
C		PER ELD-LA-4(A)D13	4-6-83 R.P.M.
D		PER ECO-LA-4(A)D14	11-10-83 M.R.M.



- 9 ⊕ INDICATES WIRE CONNECTION TO P.C. BOARD.
 - 8 → INDICATES CLOCKWISE ROTATION.
 - 7. ALL INTEGRATED CIRCUITS ARE 4156
 - 6. (F.S) INDICATES FACTORY SELECT PART.
 - 5. (F.P) INDICATES COMPONENT LOCATED ON FRONT PANEL.
 - 4. // INDICATES CHASSIS GROUND.
 - 3. ↓ INDICATES AUDIO GROUND.
 - 2. CAPACITOR VALUES ARE IN MICROFARADS.
 - 1. RESISTOR VALUES ARE IN OHMS ± 5% 1/2 W.
- NOTES: UNLESS OTHERWISE SPECIFIED.

F1
1/4A S.B. FOR 220-240VAC 50/60 HZ
OR
1/4A S.B. FOR 110-125 VAC 50/60 HZ

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.		UNITED RECORDING ELECTRONICS INDUSTRIES
FRACTIONS	DECIMALS	APPROVALS	DATE	
± .001	± .001		9-18-78	SCHMATIC COMPRESSOR / LIMITER
DRAWN P. MARON		CHECKED		
FINISH				
NEXT ASSY USED ON		MODEL NO.		SIZE
APPLICATION		DRAWING NO.		D
DO NOT SCALE DRAWING		LA4(A)		13247 D
		SHEET 1 OF 1		